

**APPLICATION OF TOTAL QUALITY MANAGEMENT AND BUILDING
MAINTENANCE OPERATIONS IN BUILDING CONSTRUCTION IN ABUJA,
NIGERIA.**

BY

CHARLES, Favour Amoto

2016/1/60155TI

**DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION,
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGER STATE.**

APRIL 2023.

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**A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY
EDUCATION, SCHOOL OF TECHNOLOGY EDUCATION, FEDERAL UNIVERSITY OF TECHNOLOGY,
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BACHELOR OF TECHNOLOGY (B. TECH) DEGREE IN INDUSTRIAL AND TECHNOLOGY
EDUCATION.**

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DECLARATION

I, **CHARLES, Favour Amoto** with matriculation number **20116/1/60155TI**, an undergraduate student of the department of Industrial and Technology Education, certify that the work embodied in this project is original and has not been submitted in part or full for any other diploma or degree of this or any other University.

.....
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.....
Signature & Date

CERTIFICATION

This project has been read and approved as meeting the requirement for the award of B. Tech degree in Industrial and Technology Education, School of Technology Education, Federal University of Technology, Minna.

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Project supervisor

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Head of Department

Sign & Date

Examiner

Sign & Date External

DEDICATION

With profound joy and gratitude in my heart, I dedicate this project to God Almighty for His Unshakable and Unbreakable Faithfulness. His Divine and constant guidance in my life has made this project a reality today. Thank God.

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ABSTRACT

This study assess the application of Total quality management and building maintenance operations in building construction in Abuja Nigeria. four research questions were developed to guide the study. The study employed a survey research design. The study used a four-point scale questionnaire, which contains a total of 39-items, as instrument. The total population of the study was 50 respondents comprising 10 supervisor and 40 site engineers. The findings of Review/analysis used to improve performance, Well-defined roles and responsibilities of project participants, Clearly defined goals and objectives, Incentives for good performance. The study recommended among other things, Firms should ensure all site personal are adequately qualified to delivery on the tasks assigned to them, materials used on site should be properly certified before usage and all stakeholders on a project should posses adequate information and full knowledge of such project before work commences.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the study

The construction sector is globally considered to be a basic industry on which the development of a country depends. To a great extent, the growth of a country and its development status is generally determined by the quality of its infrastructure and construction projects (Adam *et al.*, 2020). The building industry provides a professional service that uses specialized, project management techniques to oversee the planning, design, and construction of a project, from its beginning to its end (Olaniran *et al.*, 2015). The purpose of management is to control a project's time / delivery, cost and quality sometimes referred to as a project's "triple constraint" (Dilawo & Salimi, 2019). Management is compatible with all project delivery systems, including design-bid-build, design build, Risk and Public Private Partnerships.

The concept of quality management is to ensure efforts to achieve the required level of quality for a product which is well planned and organized. From the perspective of the building industry, quality management in construction projects should mean maintaining the quality of construction works at the required standard so as to obtain customers' satisfaction that would bring long term competitiveness and business survival for the construction companies (Low *et al.*, 2020).

Quality of a product can be measured in terms of performance, reliability and durability. Quality is a crucial parameter which differentiates an organization from its competitors. Quality management tools ensure changes in the systems and processes which eventually result in superior quality products and services. Quality management methods such as Total Quality

management have a common goal to deliver a high-quality product. Quality management is essential to create superior quality products which not only meet but also exceed customer satisfaction. Total Quality management is defined as a continuous effort by the management as well as employees of a particular organization to ensure long term customer loyalty and customer satisfaction.

Further to this, Jimoh *et al.*, (2019) also reiterated that the term quality management as used in the construction industry is all encompassing and embedded in the phenomenon itself and are concepts such as quality control, quality assurance, quality improvement, quality standards etc. The authors revealed that the earliest form of formal quality management practices in construction can be traced back to ancient Greece and Rome. In addition to the aforementioned, Kado *et al.* (2016) opined that quality management practices include all the means employed by managers in an effort to implement their quality policies. These activities include quality planning, quality control, quality assurance and quality improvement.

Many of the management practices used to support building industry are being challenged. The industry's clients are moving forward. Client's demand improved service quality, faster buildings and innovations in technology. It is no accident that the construction industry has turned to the manufacturing sector as a point of reference and source of innovation. Successful concepts derived from manufacturing, such as Total Quality Management (TQM), Reengineering and Lean (or Just-in-Time) Production, are being adopted and integrated into the construction industry. Implicitly, the successful implementation of these concepts is heavily dependent on a culture of teamwork and cooperation at both intra- and inter-organizational levels in construction

Ogunseiju *et al.* (2022) indicated that performance on a global level represents results of activities undertaken. He proceeded further to explain that performance of a project is measured as its ability to deliver the building or structure at the right time, cost and quality as well as achieving a high level of client satisfaction. It therefore stands to reason that quality performance in construction is results oriented and seeks evidence of quality awareness within the operations and output of a building/construction team. Quality performance is also defined over the long term for the effect to be permanent (Aluko *et al.*, 2021). In other words, quality performance improvements are expected to increase the productivity and profitability of contractors as well as increasing client satisfaction. Quality Management has increasingly been adopted by organizations in the building industry as an initiative to solve quality problems and to meet the needs of the final customer, if ever an industry needed to take up the concept of QMS (Quality Management System) it' s the construction industry. However, implementing QMS principles in construction industry is particularly difficult because of the many parties involved. There is therefore a need to evaluate TQM practice of contractors in Nigeria.

1.2 Statement of the problem

A careful look at Nigerian environment would reveal erratic building maintenance pattern among buildings owners/occupiers, especially, most of the public buildings are left unattended to the major preoccupation then seemed to be, construction of big edifice without considering subsequent maintenance of such a property. Coker (2016) stated that maintenance of building in Nigeria tends to be a sort of onerous task, and it is also saddle with a lot of problems which tends to hampers it and makes it a sort of herculean task. Ebekozien *et al.* (2022) stated Some of such problems being encountered in building maintenance in Nigeria and which needs to be attended to are as follows: Inappropriate maintenance policy, Non-compliance with statutory

requirements, Inability of management of organization to carry employee along in decision-making and policy formulation, Insufficient training and skilled manpower in maintenance operations, Lack of standards performance monitoring system. The above listed problem could be countered by considering certain virtues in total quality management, which tend to provide way out of the problems. It is believed that if the principle could be applied in building maintenance most or nearly all the problem arising therein would be solved. To this end therefore, this research work is about studying an approach through which TQM principles could be adopted for an effective maintenance operation.

1.3 Purpose of the study

The main purpose of the study is to assess the application of Total quality management and building maintenance operations in building construction in Abuja Nigeria. Specifically the study will determine the following:

1. The Total Quality Management practices used by contractors in building maintenance operation in Abuja
2. The level of commitment of contractors to Total Quality Management Practices in building maintenance operation in Abuja.
3. The challenges encountered by contractors while implementing Total Quality Management during the execution of maintenance operation.
4. The measures for effective quality assurance practice through the use of TQM in the building industry

1.4 Significance of the Study

Besides adding to the existing body of knowledge on this area, the study is significant in the sense that, it will demystify the existing doubts as to the practicality of Total Quality management principles in solving problems as regards building maintenance, problems such as: inadequate training of personnel insufficient resources, measurement and precision in work carried out, communication between authority and employee. This study would then enable those principles in application in building maintenance as well the two ones that are not yet in application, to be determined. This would help in how to proffer solution to other problems that would surface in building maintenance operations and how to tackle them.

1.5 Scope of the Study

The study seeks to assess the application of Total quality management and building maintenance operations in building construction in Abuja Nigeria. The scope of the study will cover The Total Quality Management practices used by contractors in building maintenance operation in Abuja, The level of commitment of contractors to Total Quality Management Practices in building maintenance operation in Abuja, The challenges encountered by contractors while implementing Total Quality Management during the execution of maintenance operation, The measures for effective quality assurance practice through the use of TQM in the building industry.

1.6 Research Questions

The following research questions will guide the study;

1. What are the Total Quality Management practices used by contractors in building maintenance operation in Abuja?
2. What are the level of commitment of contractors to Total Quality Management Practices in building maintenance operation in Abuja?

3. What are the challenges encountered by contractors while implementing Total Quality Management during the execution of maintenance operation?
4. What are the measures for effective quality assurance practice through the use of TQM in the building industry?

CHAPTER TWO

REVIEW OF RELATED LITERATURE

The review of related literature to this study is organized under the following subheadings:

2.1 Conceptual Framework

- 2.1.1 The Concept of Total Quality Management in construction practice
- 2.1.2 Quality Management in Construction Industry
- 2.1.3 The Principles Of Total Quality Management
- 2.1.4 Techniques Of Total Quality Management
- 2.1.5 Maintenance Management Practices
- 2.1.6 Building Maintenance
- 2.1.7 TQM Concept And Application

2.2 Related Empirical Studies

2.3 Summary of Review of Related Literature

2.1 Conceptual Framework

2.1.1 The Concept of Total Quality Management in construction practice

Quality may mean different things to different people. Zhu *et al.* (2016) stated that some take it to represent the products and customers satisfaction, and others interpret it as compliance with requirements. Moreover, quality was defined as the totality of features and characteristics of a product or service that bear on its ability to stated and implied needs. For construction the needs must be defined by the client. The inclusion of services is pertinent to construction, where both designers and constructors supply services as well as the product (i.e. the completed work). Hestenes *et al.* (2015) stated that although the need for quality has existed since the beginning of time, the ways and means of meeting the need for managing quality have changed dramatically.

Al-Otaibi *et al.* (2015) stated the construction industry is being viewed as one with poor quality emphasis compared to other sectors like the manufacturing and service sectors.

Zhu *et al.* (2016) stated that total quality management is increasingly being adopted by construction companies as an initiative to solve quality problems in the construction industry. In fact, a building is good quality if it will as be intended for its design life. As a true quality of the building may not be revealed until many years after completion, the notion of quality can only be interpreted in terms of the design attributes

Defining Quality on construction projects

Albalkhy and Sweis (2021) expressions have been adopted to define quality in the construction industry. Albalkhy and Sweis (2021) definition pointed to quality as "fitness for use" in terms of design; conformance, availability, safety, and field use. According to Tyagi *et al.* (2015) quality has a three-fold meaning in construction , it means getting the job done on time; it means ensuring that the basic characteristics of the final project fall within the required specifications; it means getting the job done within budget. Hussain *et al.* (2019) stated that the construction industry has numerous problems because of its complicated nature of operation. Moreover, industry is comprised of a multitude of occupations, professions and organisations. A quality construction project has to comprise all these dimensions. Actually, quality in construction is directly connected with conformity to specifications and fitness for use. According to Wong and Fung (1999), higher customer satisfaction, better project quality and higher market share often come with the adoption of TQM by such companies. These definitions are interdependent and the choice of one depends on the domain and the purpose of its use. In construction quality is

defined as "conformance to established requirements". (Muhammad, 2021). Muhammad, (2021) stated that quality management (QM) is "the quality of management" which contains leadership, communication, team work and ability to change and improve and pleasing the customer. It includes the ongoing search for opportunities to improve total quality management (TQM) is an overall concept that should be committed to by top management. According to Nicholas (2016), quality management is the "process of establishing longrange quality goals and defining the approach to meeting those goals". However, construction companies are adopting TQM to improve their performance. In addition, there is much dissimilarity between manufacturing and construction, so TQM techniques must be adapted for the construction industry. Understanding the customer's requirements is essential in ensuring 14 customer satisfaction, and the demand for the construction product must be viewed in relation to the intended use of the facility. Quality is one of the aims of standardization. The quality of a product or a complete building or other constructions is the totality of its attributes that enable it to perform a stated task or to fulfill a given need satisfactorily for an acceptable period of time. For a building and civil engineering work, a satisfactory product, although essential in itself, is not on its own sufficient. It must be incorporated in the design and construction in a correct manner. In buildings, more defects and failures arise from inadequacies in the treatment of products in design and construction than from shortcomings in the products themselves (Azizli *et al.*, 2015). In the same view Basir *et al.*, (2017) stated that Quality Management has seen a transition from reacting to the outcome of site production activities to becoming a strategic business function accounting for the *raison d' etre* of construction companies. Unless a construction company can guarantee its clients a quality product, it cannot compete effectively in the modern construction market. The management philosophy based on TQM has generated significant interest in various economies across the

World, a phenomenon that Firman *et al.* (2020) called the second industrial revolution. The increased awareness by senior management, that quality is an important strategic issue, has made it an important focus for attention at all levels of an organisation, something that Dale *et al.* (2016), all point to as evidence that the organisation has adopted a TQM philosophy. However, different researchers have adopted different definitions of TQM. Aziz, R. Z., Sumantoro and Maria (2019) said one of the common reasons for the failure of TQM is the cultural position of the company. The implementation of a TQM required a culture change and change in management behaviour. The literature will identify the important TQM culture elements that contribute to successful implementation of TQM. These elements 15 should be adopting by the construction industry in implementing TQM in Libya, Further, companies are prepared to only implement those aspects of total quality management (TQM) programs that will provide them with competitive advantage and improve their overall performance and the organisations must use a systems approach to manage their interrelated processes. Wilkinson (1994) cited that TQM is a philosophy of management derived from the work of the quality gurus. It is based on three fundamental principles: • Customer orientation to satisfy customer requirements and expectations. • Process orientation, the activities to be performed as process (inputprocess-output). • Continuous improvement. The justification of adoption of the Total Quality Management is based normally on its benefits and their effects on the organisation's future. According to Sahoo and Yadav, (2017), the justification for a firm to adopt total quality management (TQM) is normally based on the premise that it will acquire benefits. And that increase of the awareness of quality in general is a benefit obtained by the organisations with the total quality management (TQM) programme (Anil & Satish, 2019). According to Yasamis *et al.*, (2002) stated that total quality management (TQM) is seen as a continuously evolved

management system consisting of values, methodologies and tools, the aim of which is to increase external and internal customer satisfaction with a reduced amount of resources. Moreover, Aliakbarlou *et al.* (2017) said different values are included in the concept of TQM by different authors, as well as in different quality awards

2.1.2 Quality Management in Construction Industry

The concept of quality has existed for many years, but its meaning has changed and evolved over time. Before the early twentieth century, quality management meant inspecting products to ensure that they met specifications (Rotimi, 2022). This is evident in the Egyptian wall painting circa of 1450BC which showed evidence of measurement. Stones used in the pyramids 16 which were cut so well that a knife could not go between them (Rotimi, 2022). According to Rotimi (2022) around 1940s, during World War II, quality became more statistical in nature. Statistical sampling techniques were used to evaluate quality, and quality control charts were used to monitor the production process. In the 1960s, with the help of so-called “ quality gurus,” the concept took on a broader meaning. Quality began to be viewed as something that encompassed the entire organization, not only the production process. All functions were responsible for product quality and shared the costs of poor quality. However, in the 1970s and 1980s many U.S. industries had to make changes to their quality policies when they lost market share to foreign competition particularly in the auto industry. Many hired consultants and instituted quality training programs for their employees (Rotimi, 2022). Rotimi (2022) established in his study that many of the management practices used to support construction organizations are being challenged. The industry’ s clients are moving forward. Clients demand improved service quality, faster buildings and innovations in technology. In Nkrumah *et al.* (2017), Quality Management Concept is said to be structured in general according to the “ International

Organization for Standardization” ISO 9000-series and the “ Plan, Do, Check, Act” PDCA-cycle. It further illustrated the two main structures stated above as follows;

ISO 9000-series: According to EN ISO 9000 quality management is defined as “ coordinated activities to direct and control an organization with regard to quality” . Direction and control with regard to quality generally includes establishment of the quality policy and quality objectives, quality planning, quality control, quality assurance and quality improvement:

Quality planning is focused on setting quality objectives and specifying necessary operational processes and related resources to fulfill the quality objectives.

Quality control is focused on fulfilling quality requirements.

Quality assurance is focused on providing confidence that quality requirements will be fulfilled.

Quality improvement is focused on increasing the ability to fulfil the quality requirements

PDCA-cycle An important mindset of quality management is the PDCA-cycle. This cycle including the four components as Plan, Do, Check and Act (PDCA), was originally conceived by Walter Shewhart in the 1930`s, and later adopted by W. Edward Deming. The model provides in general a framework for the improvement of a process or system and is an iterative four-step quality strategy cf (Nkrumah *et al.*, 2017).

Plan: Establish objectives and processes necessary to deliver results in accordance to specification.

Do: implementation of processes **Check:** Monitor and evaluate processes and results against objectives and specifications.

Act: Take actions to the outcome for necessary improvement (e.g. improve, standardize).

2.1.3 The Principles Of Total Quality Management

The key principles of total quality management that should present the "working life" of any organization a spring to operate total Quality management are as follows (Fisher, 2019).

An organization wide commitment to quality: This entails organization making Total Quality overtly the highest priority, defining Aim, and how to achieve good health and safety condition.

Creating appropriate climate: Creating conducive environment to the parties involved. i.e. implicit mutual respect of all stakeholders involved in total quality organization with assurance that all are going to benefit from the projects.

Focus on satisfying customer' s need: This involves defining customers' need and strives to ensure its satisfaction.

Communication: Good managerial sense for both technical and managerial issues by all parties. A total quality organization communicates openly and clearly its principles, benefits, values, mission statement, and policy for quality.

Precision: Getting it right the first time to achieve near perfection or near zero defects stage, and during maintenance operations.

Adequate resources allocation and building: Total quality management would always require sufficient appropriate investment to ensure that planned activities occur.

Efficient Performance Monitoring System: Good, established conventional method of monitoring equipment performance is highly essential.

Continuous Improvement In Manpower Skill And Development: For an organization to imbibe the total quality management culture successfully, all its managers and leaders must be subjected to periodic skill development appraisal, to acquire coaching skills and interpersonal discipline.

2.1.4 Techniques Of Total Quality Management

There are six time-tested Techniques of TQM (Nair & Choudhary, 2016). They are as follows:

- 1) Empowerment: This is the transfer or delegation of responsibility and authority. Without this, empowerment fails. This works best if these four forces are operating simultaneously.
 - a) The delegator (manager) has established a clear vision, what the goals are and has communicated to the subordinates.
 - b) The delegator has established high personal and business standards and has consistently demonstrated those standards through his actions.
 - c) The delegator has established close relationship with subordinate and has trusted them to make decision.
 - d) The delegator is willing to let subordinates make mistakes, and only intervenes to prevent disaster.
- 2) Employee Participation And Involvement: In decision-making and problem solving processes.
- 3) Creativity and innovation: Valuing and respecting contrary ideas, and encourage employee with good initiative.

- 4) **Management By Score Keeping:** This borders around performance appraisal and feedback interview. When performance is measured and reported back, the rate of improvement accelerates.
- 5) **Team Building:** When several people work together to achieve a well-defined goal, the result of many far exceeds the result of a few. This is referred to as synergy, the most important benefit of team performance.
- 6) **Managers Skill Development Or Appraisal:** For effective implementation of TQM, periodic skill development is essential for all Cadres of managers.

Awareness of TQM in construction industry

Total Quality Management (TQM) is a way of thinking and a set of continuous and improvement processes for individuals, groups and whole organisations by understanding awareness of TQM as discovering better process, (Hawarna *et al.*, 2020). Syed *et al.* (2019) states that the purpose of awareness is to let everyone feel that they belong to a quality organisation. In addition, awareness means that the staff in an organisation understands the management's quality policy. If the levels of awareness of QMS issues in an organisation are very low there may also be a poor understanding about the importance of quality in international trade and globalisation of world markets. It is a result of lack of information, education and training programs available on quality issues (Hang, 2015). According to Giacino *et al.* (2018), the majority of the studies were based on the assessment of managers' awareness of a specific principle or practice of TQM like teamwork or training.

2.1.5 Maintenance Management Practices

Maintenance management is an orderly and systematic approach to planning, organizing, monitoring and evaluating maintenance activities and their costs (Blessing *et al.*, 2015). A good maintenance management system coupled with knowledgeable and capable maintenance staff can prevent health and safety problems and environmental damage; yield longer assets life with fewer breakdowns and result in lower operating costs and higher quality of life for the occupants and users (Blessing *et al.*, 2015). There is a lot of work required to set up a successful maintenance management system. However, once it is in place, most of the data and calculations remain the same from year to year. The appropriate work orders and schedule must be revised and the labour, equipment, material and contract costs updated for the following year. There are numerous computerized maintenance management systems available in the commercial market to assist in effectively managing the maintenance of on-reserve assets. The maintenance supervisor or manager must also monitor the work progress daily, weekly or monthly depending on the nature of the situation and the potential impact of a service breakdown to the users. The maintenance manager must not wait until the year end to review the budget, as it would be too late to take any corrective action if it were necessary. The supervisor should determine the cause of the variance and, where possible, develop alternative solutions or actions to reduce time and costs. Taking these steps will help improve the efficiency and effectiveness of the maintenance programme (Blessing *et al.*, 2015). Maintenance management practices include the following;

1. Maintenance practices, such as preventive maintenance plan, work scheduled and standardization of activities – acceptable standard to which the building and its services are to be maintained.
2. A formal organizational plan chart with their maintenance records.

3. Response time required and acceptable in executing maintenance works – prioritisation of buildings e.g. between core and auxiliary functions.
4. The life (functional) requirements of the buildings and their fittings and services.
5. Maintenance funding system.
6. Training programme and staffing.
7. A method of approval of work.
8. Material requisition techniques.
9. Quality assurance and
10. Maintenance strategies.

2.1.6 Building Maintenance

According to Blessing *et al.* (2015), maintenance departments are individuals liable for the organizing, scheduling and implementation of maintenance activities. Maintenance department in an organization is managed by a maintenance manager. This may be wholly in-house or, as is now much likely, may include independent bodies, such as consultants and contractors. In considering the maintenance management system to be used, the relationships with these bodies and the rest of the business organization must therefore be carefully taken into account. In a small firm, the functions may be undertaken by a member of staff in addition to his other duties, while in a larger firm there would be a separate group of people solely responsible for maintenance (Blessing *et al.*, 2015).

2.1.7 TQM Concept And Application

TQM is a procedure of managing people and the organisation processes in order to ensure customer satisfaction at every stage. The main emphasizes is on quality and communication of the quality message to create total quality (Ngatiman *et al.*, 2022). TQM has been widely implemented throughout the world. Many firms have arrived at the conclusion that effective TQM implementation can improve their competitive abilities and provide strategic advantages in the marketplace (Al-Dhaafri & Al-Swidi, 2016). TQM implementation has led to improvements in quality, productivity, and competitiveness in only 20-30% of the firms that have implemented it and reduction in rework (Ajayi & Osunsanmi, 2018). The construction industry in Nigeria is growing in complexity and in order to be competitive at the global level (Obisanya *et al.*, 2020), TQM should be strictly adhered to in order to ensure clients' satisfaction and for profitability. Many Nigeria construction companies have comprehensive quality plans just as safety plans as opined by Obisanya *et al.* (2020) but the quality of the plan does not necessarily correlate to the company quality performance. Quality in each phase is affected by the quality in the preceding phase, therefore, customer service in each phase is important for the overall quality performance of the process (Hassanain *et al.*, 2022). Quality is, therefore, an importance feature of any construction companies because the safety of the construction companies and the stakeholders depends on the quality of the structure. Ajayi and Osunsanmi (2018) reiterate that TQM as a management system has not been effective in the construction industry as much as it has been in other industries because of lack of adequate budget, failure to plan for quality, inadequate training at all levels except for top or senior management positions (Brooks *et al.*, 2021), and little recognition given to those who strive for quality improvement on their projects. Contractors have failed in setting out adequate funds required for the accomplishments of improving and maintaining the requisite quality expected of construction products and services. Saeed and

Onubi *et al.* (2020) reported that the construction industry has not fully paid attention to the application of TQM basically because the construction professionals are unaware of the TQM principles and techniques. For the industry to therefore adhere to TQM, effort must be made to spread the culture of TQM among the professionals and TQM courses should be introduced to build environment undergraduate programs. According to Ajayi and Osunsanmi (2018), the all-encompassing management philosophy, termed TQM has generated a tremendous amount of interest and has emerged in the forefront as a major management movement, influencing many sectors of the economy worldwide. The subject matter has churned up some commitment on the part of management of most contracting organizations, thereby increasing the level of quality culture available in those organizations. TQM consists of management principles aimed at achieving quality performance in all aspects, i.e. product, service, process, profit and productivity (Jimoh *et al.*, 2019). The fundamental difference between the QA/QC (Quality assurance/Quality control) approach and TQM is that the former is a “top-down” approach, whereas the latter is a centralized approach which makes TQM consists of management principles aimed at achieving quality performance in all aspects, i.e. product, service, process, profit and productivity. .The principles of TQM have been widely used by the manufacturing and service industries, and they have seemingly been welcomed by the construction industry as an opportunity to improve construction quality management (Egwunatum *et al.*, 2022). The success of applying TQM to the construction industry would be felt in the nearest time. Considerable research has been directed at implementing TQM in the construction industry. Most of which deals with specific building blocks of TQM (e.g. service quality, continual improvement), with some attention focused on identifying opportunities, barriers to and procedures for implementing TQM in construction firms.

2.2 Related Empirical Studies

Owolabi (2014) carried out a study to assess the effectiveness of maintenance practices in public schools. The Maintenance management sector in public section in Nigeria has suffered from lack of funds and negligence for a period of time. The education sector was not spare of the menace as well; huge amount of money is often invested in the provision of infrastructure in the sector while the aspect of maintenance is often neglected. Therefore in this study assessment of the effectiveness of maintenance practices in public schools was carried out using Kaduna state of Nigeria as case study. The sampling survey was limited to the existing institution. A total of eighty (80) questionnaires were administered. Eighty (80) copies of the drafted and approved questionnaires were administered with the aim of achieving the following: To assess the operational (physical-functional condition) of public schools in Kaduna state as carried out by the maintenance department. Mean item score and simple percentage was used to process the data. To examine the effectiveness of maintenance practices strategy used in maintaining the buildings. To determine the prevailing method of executing maintenance practices and study its efficiency either by direct labour or contract. To ascertain the factors that militates against. From data analysis. It was observed that lack of proper phasing of maintenance workload can give rise to uneconomical maintenance management practice. It was also observed from analysis, that some major variables lead to the inefficiency and in effectiveness of the maintenance projects includes: the occurrence of poor contract management, lack of availability of materials and the incidence of in accurate estimate.

Abdulrahim (2016) carried out a study on on assessment of quality management practices in building construction firms in Abuja. The quality of building construction projects in any country shows the level of development attained giving that the construction industry provides most of

the fixed assets of any country. The study assessed factors affecting quality management of building construction firms, conformity of firms to quality management practices and the effect of firm size to conformance with quality management practices. Purposive sampling was used and 78 questionnaires were administered to building construction firms in order to assess quality management practices in building construction firms in Abuja. The research findings showed, adequacy of site personnel (RII=0.87), certification of materials (RII=0.86) and project control (RII=0.86) ranked highly significant as factors quality management. Whereas Onsite supervision (RII=0.87), quality appraisal (RII=0.84) and education of employee on the need for quality (RII=0.84) ranked highest as the most significant among the practices that firms conform with ensure quality management. The research also established that there is some variations with regards to firm size in conformity with quality management practices. From the research findings, it was concluded that inadequate on site supervision, quality appraisal and education of employees on the need for quality management are the major practices that firms need to conform with to ensure quality management in building construction firms. The research recommends building construction firms to conform strictly to quality management practices.

Muhammad (2021) carried out a study on evaluation of total quality management practices of contractors in building industry in Abuja, Nigeria. Many of the management practices used to support construction organisations are being challenged. The industry's clients are moving forward and demanding improved quality service, faster project delivery and innovations in technology. Total Quality Management (TQM) has increasingly been adopted by construction companies as an initiative to solve quality problems and to meet the needs of the final customer. This research therefore aims at evaluating the Total Quality Management Practices of contractors in building industry in Abuja, Nigeria. The study identified TQM practices used by contractors

in housing delivery in Abuja, the level of commitment of contractors to TQM, the challenges encountered by contractors while implementing TQM and measures for effective quality assurance practice through the use of TQM. Quantitative research approach was used, field survey was carried out, structured questionnaires were administered to contractors and response were subjected to statistical analysis. The findings showed that most respondents were familiar with total quality management practices; its application was relatively low; further to this, it came to light that the potential barriers to the attainment of total quality management among construction firm are: lack of effective Supervision (3.91) ranked 1st followed by effective Communication (3.50) and Management' s Commitment to Quality Assurance (3.50) ranked 2nd, Proper Equipment available for use (3.36) ranked 3rd, Quality Assurance Team to lead the process (3.33) ranked 4th. More importantly, in curbing the above-mentioned potential barriers the study revealed the following as measures for effective quality management practices, namely: Management Commitment, Communication between Managers and Employees, Employee Involvement, Detailed and Logical Work Program, Regular Inspection and Audit of Quality Report, Training and Education of Team Members and Review/Analysis. The research therefore recommended that construction companies should create a flexible and conducive organizational atmosphere which encourages the development of total quality management practices in all aspect of their work. Furthermore, construction firms should be encouraged to apply total quality management techniques during the execution of project and engage/include personnel in charge of Quality as part of an integrated team in the Project Management and Delivery process.

2.3 Summary of Review of Related Literature

The literature review is discussed under the following subheading: The Concept of Total Quality Management in construction practice, Quality Management in Construction Industry, The Principles Of Total Quality Management, Techniques Of Total Quality Management, Maintenance Management Practices, Building Maintenance, TQM Concept And Application. Relevant and adequate literatures were reviewed in the study.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Design of the Study

The study adopt the descriptive survey research design used to assess the application of Total quality management and building maintenance operations in building construction in Abuja Nigeria. Survey design aimed at collecting data on and describing in a systematic manner, the characteristics features or facts about a given population.

3.2 Area of the study

The study will be carried out in 10 construction industries in Abuja.

3.3 Population for the Study

The population for the study consists of 50 respondents comprising 10 supervisors and 40 site engineers.

3.4 Sample and Sampling Technique

There will be no sampling since the population was small and manageable.

3.5 Instrument for Data Collection

The researcher designed a structured questionnaire as an instrument that was used in collecting data for the study. The questionnaire was made up of four sections (A, B, C, D and E). Section ‘ A’ contains items on personal information of the respondents. Section ‘ B’ seeks Total Quality Management practices used by contractors in building maintenance operation in Abuja. Section ‘ C’ find out the level of commitment of contractors to Total Quality Management Practices in building maintenance operation in Abuja. Section ‘ D’ find out challenges encountered by contractors while implementing Total Quality Management during the execution of maintenance operation. While Section ‘ E’ measures for effective quality assurance practice through the use of TQM in the building industry. The questionnaire items were based on four points scale types. Items for section ‘ B’ , ‘ C’ and ‘ D’ contain four responses category each. The response categories for section ‘ B’ , ‘ C’ and ‘ D’ are strongly Agree (SA), Agree (A), and Disagree (D) and strongly disagree (SD). These response categories will be assign numerical values of 4, 3, 2 and 1 respectively. Respondents were require checking (√) against the response category that best satisfies their opinion.

3.6 Validation of the Instrument

The instrument was validated by three lecturers in the department of Industrial and Technology Education, Federal University of Technology, Minna and contributions on the appropriateness of the instrument was considered in the production of the final copy of the research instrument.

3.7 Reliability of the Instrument

In order to determine the reliability of the research instrument, a pilot test will be conducted using fifteen in other locations. During the test, the questionnaires were distributed by the researcher. The questionnaire was filled by the respondents and then returned to the researcher. The data collected were analyzed using Cronbach Alpha.

3.8 Administration of the Instrument

The questionnaires were administered to the respondents by the researcher with the aid of three research assistants. The administered instrument was collected after a period of one week. This was to allow the respondents to have enough time to objectively respond to the instrument.

3.9 Method of Data Analysis

Data collected was analyzed using mean and standard deviation for the research questions while t-test was used to test the hypothesis at the 0.05 level of significant. A four (4) point rating scale was to analyze the data as shown below.

Strongly Agree	(SA)	=	4points (3.5 – 4.0)
Agree	(A)	=	3points (2.5 - 3.49)
Disagree	(D)	=	2points (1.5 – 2.49)
Strongly Disagree	(SD)	=	1point (1.0 – 1.49)

Therefore, the mean value of the 4 point scale is:

$$\bar{X} = \frac{4+3+2+1}{4} = \frac{10}{4} = 2.5$$

3.10 Decision Rule

The cutoff point of the mean score of 2.50 will be chosen as the agreed or disagreed point. This will be interpreted relatively according to the rating point scale adopt for this study. Therefore, an item with response below 2.49 and below was regard or consider as disagreed while an item with response at 2.5 and above was regarded or considered as agreed.

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF DATA

4.1 Research Question 1

What are the Total Quality Management practices used by contractors in building maintenance operation in Abuja?

Table 4.1: Mean responses of the site engineers and supervisor on the Total Quality Management practices used by contractors in building maintenance operation in Abuja.

S/N	ITEMS	N ₁ = 10		N ₂ =40
		\bar{X}	SD	Remark
1	Human resource	3.72	.505	Agreed
2	Contract planning unit	3.86	.359	Agreed

3	Estimating department	3.77	.576	Agreed
4	Quality assurance unit	3.90	.301	Agreed
5	Marketing department	3.78	.547	Agreed
6	Health & safety department	3.81	.512	Agreed
7	Maintenance unit	3.65	.556	Agreed
8	Contract planning unit	3.81	.402	Agreed
9	Estimating department	2.72	1.395	Agreed
10	Faster project delivery	3.43	.926	Agreed
11	Safety performance	2.99	.840	Agreed
12	Quality during/after	3.00	.447	Agreed

N=50

\bar{X} = mean of the respondents

N₁ = Site engineer

N₂ = supervisor

SD = standard deviation of the respondents

Table 4.1 showed that both the site engineers and supervisor agreed on all items from 1 to 12. This is because none of the mean response was below 2.50 which was the beach mark of agreed on the 4-points response options. The standard deviation score ranged between 0.359 and 1.395. This showed that the responses of the site engineers and the supervisor on the items were not divergent.

4.2 Research Question 2

What are the level of commitment of contractors to Total Quality Management Practices in building maintenance operation in Abuja?

Table 4.2: mean response of the site engineers and supervisor on the level of commitment of contractors to Total Quality Management Practices in building maintenance operation in Abuja.

		N₁= 10		N₂=40
S/N	ITEMS	\bar{X}	SD	Remark
1	Competent Project Team	3.63	.603	Agreed
2	Authority of the Project Manager	3.81	.680	Agreed
3	Project Understanding	3.70	.648	Agreed
4	Meeting Quality Standard	3.81	.602	Agreed
5	Client Involvement	3.67	.674	Agreed
6	Project Mission	3.76	.768	Agreed
7	Adequate Resources	3.73	.548	Agreed
8	Organization guidelines	3.81	.602	Agreed
9	Maintenance Management	3.65	.600	Agreed
10	Product evaluation	3.86	.478	Agreed
11	Faster project delivery	3.61	.649	Agreed
12	Safety performance	3.86	.478	Agreed
13	Quality during / after	3.32	.589	Agreed
14	Meeting construction budget	2.90	.436	Agreed
15	Making adequate profit	3.63	.603	Agreed

N=50

\bar{X} = mean of the respondents

N₁ = Site engineer

N₂= Supervisor

SD = standard deviation of the respondents

Table 4.2 showed that both the site engineers and supervisors agreed on all items. This was because none of the mean response was below 2.50 which was the bench mark of agreed on the

4-point response options. The standard deviation score ranged between 0.436 and 0.768. This showed that the responses of the site engineers and supervisors on the items were not divergent.

4.3 Research Question 3

What are the challenges encountered by contractors while implementing Total Quality Management during the execution of maintenance operation?

Table 4.3: mean responses of the site engineers and supervisor on the challenges encountered by contractors while implementing Total Quality Management during the execution of maintenance operation.

		N ₁ = 10	N ₂ =40		
S/N	ITEMS	\bar{X}	SD	Remark	
1	Lack of effective supervision	3.86	.473	Agreed	
2	Lack of effective communication	3.48	.680	Agreed	
3	Lack of management' s commitment to Quality Assurance	3.70	.515	Agreed	
4	Lack of proper equipment available for use	3.48	.680	Agreed	
5	Lack of a Quality Assurance team to lead the process	2.44	1.356	Agreed	
6	Personnel unable to thoroughly read and understand contract documents (especially specification for works)	3.43	.870	Agreed	
7	Setting unrealistic deadlines	2.68	.777	Agreed	
8	Field Employees regarding Quality Assurance as irrelevant	3.67	.483	Agreed	
9	Excessive “ paper work” (Bureaucracy)	3.87	.404	Agreed	
10	Working with new people/employees most often	3.57	.746	Agreed	
11	High Labour turnover the company	2.84	.926	Agreed	
12	Complex designs (Unable to interpret complex	3.48	.814	Agreed	

	designs)			
13	Worker attitude or “ bad seed” effect	3.53	.798	Agreed
14	Lack of skilled workers available	3.67	.577	Agreed
15	Transient nature of workforce	3.68	.631	Agreed

N=50

\bar{X} = mean of the respondents

N₁ = Site engineer

N₂= supervisor

SD = standard deviation of the respondents

Table 4.3 showed that both the site engineers and supervisors agreed on all items from 1 to 15. This was because none of the mean response was below 2.50 which was the bench mark of agreed on the 4-point response options. The standard deviation score ranged between 0.484 and 1.356. This showed that the responses of the site engineers and supervisors on the items were not divergent.

4.4 Research Question 4

What are the measures for effective quality assurance practice through the use of TQM in the building industry?

Table 4.4: mean responses of the site engineers and supervisor on the measures for effective quality assurance practice through the use of TQM in the building industry.

		N₁= 10	N₂=40	
S/N	ITEMS	\bar{X}	SD	Remark
1	Management commitment	3.48	.873	Agreed
2	Communication between managers and employees	3.65	.817	Agreed

3	Employee Involvement	3.52	.680	Agreed
4	Detailed and logical work program	3.76	.582	Agreed
5	Regular inspection and audit of quality report	3.67	.483	Agreed
6	Training and education of team members	3.68	.611	Agreed
7	Review/analysis used to improve performance	3.67	.483	Agreed
8	Well-defined roles and responsibilities of project participants	3.54	.797	Agreed
9	Clearly defined goals and objectives	3.76	.436	Agreed
10	Incentives for good performance	3.53	.596	Agreed
11	Subcontractors involvement in the quality process	3.67	.483	Agreed
12	Regular meetings of project participants	3.15	.557	Agreed

N=50

\bar{X} = mean of the respondents

N₁ = Site engineer

N₂ = supervisor

SD = standard deviation of the respondents

Table 4.4 showed that both the site engineers and supervisors agreed on all items from 1 to 12. This was because none of the mean response was below 2.50 which was the bench mark of agreed on the 4-point response options. The standard deviation score ranged between 0.436 and 0.873. This showed that the responses of the site engineers and supervisors on the items were not divergent

Findings of the Study

The following are the main findings of the study; they are prepared based on the research questions and hypothesis tested.

1. The finding on the Total Quality Management practices used by contractors in building maintenance operation in Abuja showed that all the respondents agree on all the items, among all is Quality assurance unit.
2. The finding on the level of commitment of contractors to Total Quality Management Practices in building maintenance operation in Abuja shows that showed that all the respondents agree on all the items, among all is Maintenance Management.
3. The findings on challenges encountered by contractors while implementing Total Quality Management during the execution of maintenance operation shows that showed that all the respondents agree on all the items, among all is Lack of management' s commitment to Quality Assurance.
4. The findings on measures for effective quality assurance practice through the use of TQM in the building industry shows that showed that all the respondents agree on all the items, among all is Well-defined roles and responsibilities of project participants.

Discussion of Findings.

The result from table 4.1 shows the findings on the Total Quality Management practices used by contractors in building maintenance operation in Abuja. The findings among others revealed the Human resource, Contract planning unit, Estimating department, Quality assurance unit, Marketing department, Health & safety department, Maintenance unit, Contract planning unit, Estimating department, Faster project delivery, Safety performance, Quality during/after. The findings of the study is inline with Ye *et al.* (2015) quality management is essential in any construction activities been carried out.

Table 4.2 shows the result of the findings on the level of commitment of contractors to Total Quality Management Practices in building maintenance operation in Abuja. The findings of the

study among others Competent Project Team, Authority of the Project Manager, Project Understanding, Meeting Quality Standard, Client Involvement, Project Mission, Adequate Resources, Organization guidelines, Maintenance Management, Product evaluation, Faster project delivery, Safety performance, Quality during / after, Meeting construction budget, Making adequate profit. The findings of the study is inline with Shamsuddin *et al.* (2015) that contractors level of commitment to quality management is high because every contractor want to deliver a good job and make name.

The result from table 4.3 reveal the challenges encountered by contractors while implementing Total Quality Management during the execution of maintenance operation. The findings of the study among others revealed that Lack of effective supervision, Lack of effective communication, Lack of management' s commitment to Quality Assurance, Lack of proper equipment available for use, Lack of a Quality Assurance team to lead the process, Personnel unable to thoroughly read and understand contract documents (especially specification for works), Setting unrealistic deadlines, Field Employees regarding Quality Assurance as irrelevant, Excessive “ paper work” (Bureaucracy), Working with new people/employees most often, High Labour turnover the company, Complex designs (Unable to interpret complex designs), Worker attitude or “ bad seed” effect, Lack of skilled workers available, Transient nature of workforce

The result from table 4.4 reveal the measures for effective quality assurance practice through the use of TQM in the building industry. The findings of the study revealed that Management commitment, Communication between managers and employees, Employee Involvement, Detailed and logical work program, Regular inspection and audit of quality report, Training and education of team members, Review/analysis used to improve performance, Well-defined roles and responsibilities of project participants, Clearly defined goals and objectives, Incentives for

good performance, Subcontractors involvement in the quality process, Regular meetings of project participants.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the Study

The main focus of this research study was to assess the application of Total quality management and building maintenance operations in building construction in Abuja Nigeria.

Chapter 1 of the study discussed the background of the study, the statement of problem, purpose, significance, scope and the research questions were all stated and discussed for the conduct of this research.

The review of related literature looked into The Concept of Total Quality Management in construction practice, Quality Management in Construction Industry, The Principles Of Total Quality Management, Techniques Of Total Quality Management, Maintenance Management

Practices, Building Maintenance, TQM Concept And Application. Various views of different authors concerning the topic were harmonized in a comprehensive literature review and empirical studies.

A survey approach was used to developed instrument for the study; the respondents identified as the population of the study were the site engineers and supervisor. The entire respondents were used. A number of 50 questionnaires were administered. The instrument used was analysed using frequency count, and mean scores. The research questions were discussed base on the findings from the responses and results of the instrument used.

Implication of the study and conclusions were also drawn from the findings discussed. Recommendations and suggestions for further study were formulated and stated according to the findings of the study.

5.2 Implication of the Study

The findings of the study had implications for government, Building construction industries. From the outcome of the study, Total Quality Management practices therefore remain optimum for achieving effective project performance in all types of infrastructural development. To this end, the recommendations submitted in this research would assist contractors in practicing effective total quality management during the execution of their projects.

5.3 Contribution to Knowledge

- The findings will contribute to builder's experience as the study will ensure that contractors and site supervisors are updated on a daily basis through training in their discipline for tackling maintenance operations in building.

- Contractors should be able to train competent site supervisors and engineers on the technical know how and skills required for quality assurance through the use of TQM in the building industry
- There should be adequate use of quality control circles and motivation programs to encourage employee participation and contribution

5.4 Conclusion

Based on the findings of the study, meeting project deadline and quality were the most of research factors considered in project performance measurement. In addition, the most significant indicators for Quality or getting more jobs as a result of previous good works done, management commitment to quality and the overall client or customer satisfaction. Furthermore, the most severe challenges encountered during the implementation of Total Quality management are; lack of effective supervision, lack of effective communication, lack of management's commitment to quality assurance, lack of proper equipment available for use and lack of a quality assurance team to lead.

5.5 Recommendations

Based on the findings of the study, the following recommendations were made:

1. Firms should ensure all site personal are adequately qualified to delivery on the tasks assigned to them, materials used on site should be properly certified before usage and all stakeholders on a project should posses adequate information and full knowledge of such project before work commences..
2. Firms need to invest more in the education and training of employees on quality management systems and the need to adhere to suitable quality management practices, also firm need to ensure all employees in charge of supervision on site are adequately

qualified for such positions, firms should also embark on frequent quality appraisal of their activities and comply to laid down industry standards.

3. Managers of the various construction firms should be encouraged to used total quality management techniques in the execution of projects.

5.6 Suggestion for Further Study

The following are suggested for further studies:

1. Factors affecting quality management practices in building construction firms.
2. Development of a framework quality management practices in building construction firms.

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Appendix

QUESTIONNAIRE

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGER STATE
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION

A QUESTIONNAIRE ON APPLICATION OF TOTAL QUALITY MANAGEMENT AND
BUILDING MAINTENANCE OPERATIONS IN BUILDING CONSTRUCTION IN ABUJA
NIGERIA

INTRODUCTION: Please kindly complete this questionnaire by ticking the column that best present your perception about the topic. The questionnaire is for research purpose and your view will be confidentially and strictly treated in response to the purpose of the research work.

SECTION A

PERSONAL DATA

Supervisors:

Site engineers:

Note: A four (4) point scale is used to indicate your opinion, tick the options which best describe your agreement as shown below:

Strongly Agree (SA) = 4points

Agree (A) = 3points

Disagree (D) = 2points

Strongly Disagree (SD) = 1point

Section B: What are the Total Quality Management practices used by contractors in building maintenance operation in Abuja?

S/N	Items	Scales			
		SA	A	D	SD
1	Human resource				
2	Contract planning unit				
3	Estimating department				
4	Quality assurance unit				
5	Marketing department				
6	Health & safety department				
7	Maintenance unit				
8	Contract planning unit				
9	Estimating department				
10	Faster project delivery				
11	Safety performance				
12	Quality during/after				

Section C: What are the level of commitment of contractors to Total Quality Management Practices in building maintenance operation in Abuja?

S/N	Items	Scales			
		SA	A	D	SD
1	Competent Project Team				
2	Authority of the Project Manager				
3	Project Understanding				
4	Meeting Quality Standard				
5	Client Involvement				
6	Project Mission				
7	Adequate Resources				

8	Organization guidelines				
9	Maintenance Management				
10	Product evaluation				
11	Faster project delivery				
12	Safety performance				
13	Quality during / after				
14	Meeting construction budget				
15	Making adequate profit				

Section D: What are the challenges encountered by contractors while implementing Total Quality Management during the execution of maintenance operation?

S/N	Skill Items	Scale			
		SA	A	D	SD
1	Lack of effective supervision				
2	Lack of effective communication				
3	Lack of management' s commitment to Quality Assurance				
4	Lack of proper equipment available for use				
5	Lack of a Quality Assurance team to lead the process				
6	Personnel unable to thoroughly read and understand contract documents (especially specification for works)				
7	Setting unrealistic deadlines				
8	Field Employees regarding Quality Assurance as irrelevant				
9	Excessive “ paper work” (Bureaucracy)				

10	Working with new people/employees most often				
11	High Labour turnover the company				
12	Complex designs (Unable to interpret complex designs)				
13	Worker attitude or “ bad seed” effect				
14	Lack of skilled workers available				
15	Transient nature of workforce				

Section E: What are the measures for effective quality assurance practice through the use of TQM in the building industry?

S/N	Skill Items	Scale			
		SA	A	D	SD
1	Management commitment				
2	Communication between managers and employees				
3	Employee Involvement				
4	Detailed and logical work program				
5	Regular inspection and audit of quality report				
6	Training and education of team members				
7	Review/analysis used to improve performance				
8	Well-defined roles and responsibilities of project participants				
9	Clearly defined goals and objectives				

10	Incentives for good performance				
11	Subcontractors involvement in the quality process				
12	Regular meetings of project participants				